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Method for Production of a Fixing Piece

The process relates to a method for production of a fixing piece used in particular for fastening cover material to upholstery components of motor vehicle seats, a process in which a profile component is connected to a separately produced sew-on tag which is introduced at least partly into a mounting opening in the profile component, the profile component and the sew-on tag consisting predominantly of plastic materials at least at their bonding point.

DE-U-89 07 459 discloses an insertion rod for shaping upholstery materials covered externally in the case of upholstered furniture and similar upholstered seat components, this rod consisting of a one-piece extruded shaping rod made of a plastic to which is rigidly connected a separately produced sew-on tag for its bonding to the cover material. The shaping rod has a two-sided shaping profile the two sides of which are joined at their base by a narrow connecting strip and which delimit a mounting slot extending from this strip for the sew-on tag, which is rigidly bonded to the adjoining interior surface of the two profile sides.

To apply the disclosed solution a fastening component consisting of the insertion rod as profile component and the sew-on tag a bonding process is accordingly used, a process in which the plastic materials of profile component and sew-on tag are melted and joined together by pressing. In the disclosed bonding processes melting of the plastic materials results in damage, especially in the transitional area between the bonding seam and the adjoining plastic material of the components to be bonded, something which correspondingly reduces the tear resistance. If thermal peaks occur during the bonding process the danger exists that the bonding seam itself may be directly damaged. In addition, the known bonding processes require application of additional bonding heat in order to produce the bond, so that machinery and energy expenditures are increased in the disclosed processes, something which correspondingly increases manufacturing costs. The disadvantages in question could also be encountered if in addition to the disclosed process specified for the German utility model the bonding were to be effected by introduction of an additional material, although this has not been disclosed directly in connection with this utility model.

EP 1 060 092 B1 discloses another fastening system for a passenger seat having an upholstery element of a foam material enclosed in at least one upholstery cover component which is connected to a shaping strip serving as interlocking means as profile component and having on the exterior circumference interlocking elements, a longitudinal channel adapted to the shape of the respective shaping strip being present in the foam upholstery element. The longitudinal channel in question in the upholstery element has in it recesses in the longitudinal direction which serve the purpose of engagement of the interlocking elements of the profile component and which end in the longitudinal channel and are in the form of grooves. The disclosed shaping strip is configured as profile component as a semicircular rod and thus has a convex contact surface on its side facing the foam, while on its opposite side the shaping strip is configured to be level and is provided in its center with a slot-like seating channel as mounting opening for the sew-on tag, to which in turn the upholstery cover component is fastened.

To produce this disclosed means of fastening the sew-on tag may in turn be bonded to the shaping strip as profile component as described above the foregoing or the respective bond is effected by adhesive means, a specially adapted plastic adhesive readily obtainable on the market effecting the strong bond required. Since such adhesives are generally very expensive to produce, they make production of the fastening system more expensive, and, if the adhesive is configured as a two-component system, it must first be allowed to set properly for production of the strong bond, something which lengthens the production time required and accordingly increases the cost. Since a large number of the plastic adhesives currently used contain solvents, evaporation of the solvent results in embrittlement of the areas to which adhesive is applied, so that failure of the glued seam and thus of the point of bonding of the shaping strip and the sew-on tag may occur during the effective service life, at least in the long term. Nor are adhesives containing solvents to be recommended for reasons of protecting the environment, in that they make subsequent recycling of seats and seat parts more difficult.

On the basis of this state of the art the invention has the object of further improving the disclosed means to the end that the production process for the fastening component in question consisting of a profile component and sew-on tag may be effected rapidly and at low cost and yet a very strong bond may be achieved and greater allowance may be made for environmental aspects. An object as thus formulated is attained by a process having the characteristics specified in claim 1 in its entirety.

In that, as specified in the characterizing part of claim 1, the melting point ranges selected for the plastic materials employed for the profile component and sew-on tag may vary in such a way that one plastic material remains more or less stable in shape when subjected to thermal action as the bond is established and in that the other plastic material extends into recesses consisting of a plastic material and hardens during cooling, a kind of intrusion solution is realized, one in which a part of the melted or plasticizable plastic material penetrates cavities (recesses) in the other plastic material and hardens there to produce a positively locked bond, the

plastic material having the recesses remaining unaffected in its structural configuration because of the different range of melting point temperatures. Consequently, what is effected by application of the bonding process claimed for the invention is not sealed or adhesive bonds; what occurs rather is that the plastic material of a part of the bond is positively locked in the plastic material of the other bonding component and thus is kept stable by a form of pour-in or intrusion process.

The plastic materials are neither damaged nor strained thermally in the embedding process in question; this favors production of a strong bond at the point of bonding of the profile component and sew-on tag. A plurality of options for anchoring the plastic materials to each other are provided by the pour-in or intrusion process, something which results in high holding forces. The average expert in the field of the respective bonding technology is also surprised to learn that, without resorting to a bonding process and without additional materials such as an adhesive, very strong bonds are obtained in this manner; tensile and tearing tests have shown that it is the initial components such as profile components or sew-on tags which fail rather than the bonding thus established by intrusion. In addition, omission of adhesives containing solvents makes a greater contribution to more stringent environmental aspects and the fastening component may immediately undergo environmentally sound recycling.

In one preferred embodiment of the process claimed for the invention provision is made such that the profile component is made from an extrudable plastic material and such that the sew-on tag consists of a non-woven material, a formed fabric in particular. In the respective configuration the plastic material of the profile component is subjected to thermal action and penetrates the interstices (recesses) of the fiber clusters of the formed fabric in order thus to establish the intrusion bond. Practical experiments have demonstrated that only a few layers of fiber on the non-woven material side are required to create the depth of penetration for the melted-on plastic material in order to produce the effective high-strength bond.

It has been found to be especially advantageous to make the profile component itself of a soft polyvinyl chloride (PVC) material or of a polypropylene block copolymer. In addition, the sew-on tag preferably consists of a polyester non-woven material.

In one especially preferred embodiment of the process claimed for the invention the sew-on tag is introduced into the mounting opening in the profile component immediately after the tag has undergone extrusion, the penetration process as thus conceived being initiated by pressing together the wall components adjacent to the insertion opening with the accommodated components of the sew-on tag. The possibility also exists, however, of introducing and applying the sew-on tag simultaneously with extrusion of the profile component.

Although the term "sew-on tag" is used in the specification and in the patent claims to describe the connecting component between upholstery cover and upholstery component, especially in the form of elastic foam components, it is not regarded as absolutely necessary for the upholstery cover, for example, in the form of a upholstery cover material of a motor vehicle seat, to be secured by the sew-on tag. The bond in question may rather also be produced by way of adhesives, thermal bonding, or the like. In addition, the profile component need not be anchored directly in the foam of the individual upholstery components. The possibility also exists, as has been demonstrated in the prior art, of introducing into the foam shaped interlocking elements to which the strip-like profile components may be clip-connected for fastening the upholstery cover to the upholstery points referred to.

Reference will now be made in greater detail to the drawings of the process claimed for the invention, in which, in diagrammatic form and not drawn to scale,

FIG. 1 is a perspective view of a partial section of a foamed upholstery element with slotted opening and longitudinal channel;

FIG. 2 a perspective view of a partial section of a shaping strip with sew-on tag such as may be introduced into the longitudinal channel of the upholstery element shown in FIG. 1;

FIG. 3 two different scanning electron microscope photographs of gold-sputtered parts relating to the bonding point of profile component and sew-on tag as shown in FIG. 2 showing a part of the bonding wall sections involved.

The fastening system shown in FIGS. 1 and 2 may be used for a vehicle seat (not shown), such as a motor vehicle or aircraft passenger seat. However, applications in the area of medical technology for treatment chairs or for utilitarian furniture for residential living are also conceivable. Such seats consist essentially of a seat component and a backrest component provided with upholstery, in particular in the form of individual upholstery components 10 (see FIG. 1). Upholstery components 10 such as this consist of plastic material foam molded *in situ* enclosed on the exterior in at least one upholstery cover component (not shown), such as in the form of upholstery cover materials or the like. The fastening component in question, which fastens the upholstery cover component to the upholstery component 10 in assignable seam patterns, serves to bond the upholstery cover to the upholstery component 10.

The fastening component has for this purpose at least one strip-shaped or rod-shaped profile component 12 serving as interlocking means which is flexible and is connected to the fastening component by any desired assignable separating seams on the upholstery cover component. As is shown by FIG. 2 in particular, the profile component 12 has interlocking elements 14 on the external circumference side. As is shown in FIG. 1, there is in the upholstery component 10 a longitudinal channel 16 adapted to the shape of the respective profile component 12, such longitudinal channel having in its longitudinal direction additional longitudinal channels 18 which are provided for engagement with the interlocking elements 14. The longitudinal

channel 16 is configured to be more or less round in cross-section, a slotted opening 20 communicating with the longitudinal channel 16 emerging to the exterior on the outside of the foam upholstery element 10. As FIG. 1 shows, the slotted opening 20 widens from the longitudinal channel 16 to the outside 22 as a ledged step 24 in free cross-section. The recesses 18 of the longitudinal channel 16 lie diametrically opposite each other in the longitudinal direction and communicate in the form of grooves with the longitudinal channel 16. The other longitudinal channels 18 are configured as groove-like hollow profile ridge sections.

As is also shown in FIG. 1, the interlocking elements 14 form an integral part of the profile component 12 and as shaping extensions engage the groove-like additional longitudinal channels 18 over their entire longitudinal orientation. The respective profile component 12 to be introduced into the associated longitudinal channel 16 is provided on its side facing away from the slotted opening 20 with a contact surface 26 convex in configuration and otherwise is configured to be level on its side 28 facing away from the slotted opening. The contact surface 26 is bounded on the edge in the longitudinal orientation of the profile component 12 by the immediately following interlocking elements 14. The respective sectional portion 30 between two interlocking elements 14 which follow in sequence on the side of the contact surface 26 is also configured to be convex and accordingly provided with a rounding, while the next following sections 32 of each side wall of the profile component 12 are designed to be level.

The level rear side 28 of the profile component 12 is provided in the center with a slot-like seating channel 34 as mounting opening which extends to communicate with the slotted opening 20 when the profile component 12 has been introduced into the longitudinal channel 16. This slot-like mounting opening 34 of profile component 12 serves to receive a so-called sew-on tag 36 which is configured as a connecting strip extending between the profile component 12 and the upholstery cover component (not shown) stretched along a seam boundary, the rear free end of the sew-on tag 36 as viewed in the direction of FIG. 2 being rigidly connected to the respective upholstery cover component, either by sewing, stitching, bonding, adhesion, or the

like. Consequently, the term "sew-on tag" is not restricted exclusively to bonds in which the upholstery cover is sewn onto the connecting strip 36. Hence the profile component 12 may be connected to the upholstery cover by way of the sew-on tag 36 in question, the sew-on tag 36 then extending under tension through the slotted opening 20 in the upholstery component 10 and the upholstery cover material tending to pull in the direction of the longitudinal channel 16.

The profile component 12 configured to be more or less solid and customarily referred to in technical language also as "piping profile" preferably is a monoextrudate and consists of a soft plastic material. Preference is given for the profile material to a soft polyvinyl chloride (PVC) material the melting range of which preferably is > 75 °C. The temperature at which the material is to be processed preferably falls within the range of 140 °C to 160 °C. The soft PVC material in question as shaped material may also be replaced by a polypropylene block copolymer with a softening point of around 125 °C, a melting point of around 163 °C, and a processing temperature of around 200 °C. In addition, the profile may also be of a polyethylene material the softening point of which is around 90 °C and whose melting point is around 115 °C. Preference is given in the case of the sew-on tag 36 to use of a polyester non-woven material with a melting point of 256 °C and a softening point above 220 °C.

Reference will now be made to a detailed description of the process claimed for the invention for producing a fastening component consisting of the profile component 12 and the sew-on tag 36, which, as has already been stated, is used in particular for fastening upholstery cover materials to upholstery components of motor vehicle seats, a process in which the profile component 12 is connected to the separately produced sew-on tag 36, which is engaged along its one free end in the mounting opening 34 of the profile component 12, the profile component 12 and the sew-on tag 36, as has already been pointed out, at their common bonding point consisting predominantly of plastic materials of the type described in the foregoing.

In that different melting temperature ranges as indicated above have been selected for the plastic materials employed for the profile component 12 and sew-on tag 36 as described in the foregoing, the shape of one of the plastic materials remains more or less stable when subjected to thermal action in production of the bond and the other plastic material is introduced into recesses 38 (see FIG. 3) made up of a plastic material and solidifies during cooling in the recesses 38 in question. In order to produce the bond itself, the sew-on tag 36 is introduced into the mounting opening 34 of the profile component 12 either immediately after its extrusion process or simultaneously with this process, the penetration process (intrusion) being initiated by subsequent pressing together of the wall components 40 of the profile component 12 adjoining the mounting opening 34 and the parts of the sew-on tag 36 which have been introduced.

The sew-on tag 36, configured to be flexible, consists essentially of a plastic non-woven material or of another non-woven material not consisting of woven or knitted surface formations of different fiber materials. The fibers in question may also be in the form of continuous fibers or staple fibers and the fiber layers of the non-woven sew-on tag 36 made of individual fibers are accordingly shown on the left as viewed in the direction of FIG. 3. As FIG. 3 relating to bonding of profile component 12 to sew-on tag 36 also shows, the plastic material of the profile component 12, as a result of intrusion, penetrates the interstices between the individual fibers 42 of the fiber layers 44 of the sew-on tag 36 and encloses the respective fibers 42, without bonding of the plastic materials of sew-on tag 36 and profile component 12 to each other; the fibers 42 rather are enclosed by positively locking by the plastic material of the profile component 12 by pouring in or embedding. Experiments have shown that in order to produce high-strength bonding it suffices for the first adjacent fiber layers 40 of the sew-on tag 36 to be enclosed along the wall components 40 and that complete intrusion of the entire non-woven cross-section of the sew-on tag 36 by the fiber layers is not required for high-strength bonding.

Since integral casting of one plastic material with the other plastic material does not result in bonding of the plastic materials to each other, in any event the possibly damaging

introduction of heat otherwise customary in sealing is avoided, and since at least the plastic material of one bonding component remains undamaged, a plurality of anchor points are obtained which make it possible to obtain a high-strength bond. It has been found that it is the non-woven material which fails in tensile or adhesion tests rather than the bond of profile component 12 with sew-on tag 36 obtained by way of an intrusion process.

In other exemplary embodiments not shown it is also conceivable that one might select plastic materials with their different melting point ranges so that the material of the sew-on tag 36 intrudes into the interstices of the plastic material of the profile component 12 or that materials are selected so that alternate intrusion or blending is possible. The non-woven materials referred to could also be replaced by woven or interlaced fiber clusters, but in that possibly fewer interlocking and tying points might remain for the plastic material to be poured in, loss of strength at the bonding point would have to be expected.